What is claimed is:

1. A semiconductor optical amplifier comprising:

a first mirror disposed on a substrate;

an active region consisting of an optical cavity having gain medium, said optical cavity being disposed adjacent said first mirror;

a second mirror disposed on said active region on a surface opposite said first mirror;

input and output portions formed in said mirrors, said input and output portions having formed layers of reduced reflectivity relative to a corresponding first or second mirror; and

a longitudinal waveguide connecting said input and output ports.

2. The semiconductor optical amplifier of claim 1, whereas said gain medium is electrically or optically pumped.

3. The semiconductor optical amplifier of claim 1, whereas the input and output ports lie on the same sides of the vertical structure.

4. The semiconductor optical amplifier of claim 1, whereas the input and output ports lie on opposite sides of the vertical structure.

5. The semiconductor optical amplifier of claim 1, whereas said first and second mirrors consist of distributed Bragg reflectors from the group of a series of high and low index lattice-matched or metamorphic semiconductor layers disposed on either of said substrate or said first mirror by epitaxial growth.

6. The semiconductor optical amplifier of claim 1, whereas said second mirror consists of a distributed Bragg reflector from the group of a series of high and low index dielectric layers disposed on said first mirror by non-epitaxial growth.

7. The semiconductor optical amplifier of claim 1, whereas said longitudinal waveguide is gain/loss modulated in the lateral direction.

8. The semiconductor optical amplifier of claim 1, whereas said longitudinal waveguide is index modulated in the lateral direction.

9. The semiconductor optical amplifier of claim 1 whereas said first mirror, said optical cavity with gain material, and said second mirror are composed of lattice-matched semiconductor material, whereby and said longitudinal waveguide is formed by either etch and regrowth or ridge waveguide technique.

10. The semiconductor optical amplifier of claim 1 whereas said first mirror and said optical cavity with gain material are composed of lattice-matched semiconductor material, said second mirror is composed of metamorphic semiconductor material, and said longitudinal waveguide is formed by etch and oxidation of said metamorphic material.

11. The semiconductor optical amplifier of claim 1 whereas said first mirror and said optical cavity with gain material are composed of lattice-matched semiconductor material, said second mirror is composed of dielectric material, and said longitudinal waveguide is formed via the effective index waveguide technique.

12. The semiconductor optical amplifier of claim 2 whereas said optical pumping is provided by a monolithically grown VCL structure that is wafer-fused to said SOA structure.

13. A method for producing a semiconductor optical amplifier, comprising the steps of:

growing an epitaxial DBR mirror with cavity and gain region;

forming a hybrid cavity with additional dielectric material;

patterning a waveguide using an ion implant mask in the shape of a waveguide for current restriction;

implanting ions into said cavity to provide current confinement in said gain region of said waveguide;

etching a step in said dielectric material using said ion implant mask;

removing said ion implant mask;

forming a dielectric DBR mirror on said hybrid cavity of said waveguide;

etching vertical holes or vias in said mirror adjacent to said waveguide; and

attaching electrodes in said vertical holes and on said substrate.

14. The method of claim 13, further including adding anti-reflection (AR) coating to said vias at input and output ports of said waveguide.

15. A semiconductor optical amplifier product made by the process of claim 13.

16. A semiconductor optical amplifier product made by the process of claim 14.